

THE LOWER THERMOSPHERE WIND REGIME FROM
SIMULTANEOUS OBSERVATIONS OVER EUROASIA
(COLLM, DUSHANBE, FRUNZE)

R. Schminder, D. Kurschner,
Geophysical Observatory, Collm, DDR

K. A. Karimov, R. B. Bekbasarov,
Institute of Physics, Frunze, USSR

L. A. Riazanova,
Central Aerological Observatory, Dolgoprudny, USSR

R. P. Chebotarev, Kh. Nabotov
Institute of Astrophysics, Dushanbe, USSR

The circulation in the lower thermosphere as determined from the results of measurements in 1984 in Collm, Volgograd, Frunze and Dushanbe is considered in the present report. In Collm ionospheric drift measurements were taken using the method of spaced reception in the long wave range. The other three stations used the D_2 method. Average daily values of wind velocity were used. Discontinuity of measurements ranged from a day to a week. Preliminary data in Collm were reduced to the common average height of 93 km with the help of vertical profiles of wind velocity components.

Figures 1 and 2 present the results of measurements of zonal and meridional wind velocity components at the above mentioned stations. In Fig. 1 wind direction from west to east (westerly winds) corresponds to positive values. In Fig. 2 wind direction from south to north (southerly winds) corresponds to positive values.

Zonal circulation changes from westerly to easterly winds were observed in the winter, in periods of spring time reversal and during stratomesospheric rises in temperature. In January one local rise in temperature was observed. At the lower thermosphere level this rise in temperature caused a change in the sign of the circulation only over Collm. The other stations measured in this period only a tendency toward weakening of the westerly circulation. An especially powerful warming in the stratosphere was observed between the end of February and the beginning of March. Easterly winds were observed at all four stations. In the stratosphere, the pronounced cyclonic vortex was surrounded by a well developed zone of high pressure with two very active centers - over the Pacific and North Africa. They intensified almost simultaneously and the warming spread over a vast territory -- all over Euroasia and the polar region. As a result of the final warming and rapid destruction of the cyclonic vortex a baric and circulatory reversal occurred in the middle of March.

In the same period the spring time reversal process began in the lower thermosphere. The reversal processes were marked by the intensity of the easterly winds and their duration and dates. In the course of the whole year considerable uncorrelated variation in magnitude and direction of the meridional wind was observed.

In the summer in the lower thermosphere an ordinary summer circulation was observed. In the stratomesosphere, the cyclonic vortex had also a

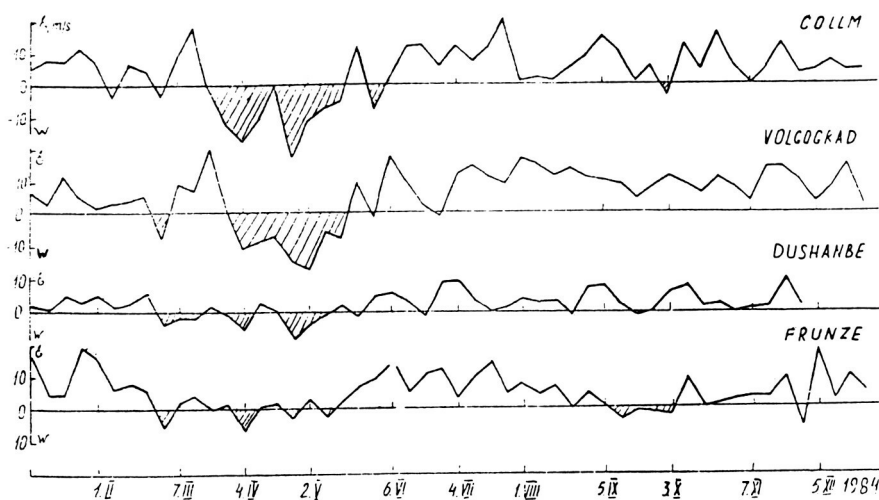


Fig. 1 Zonal winds at 93 km for 1984 from Collm, Volgograd, Frunze and Dushanbe.

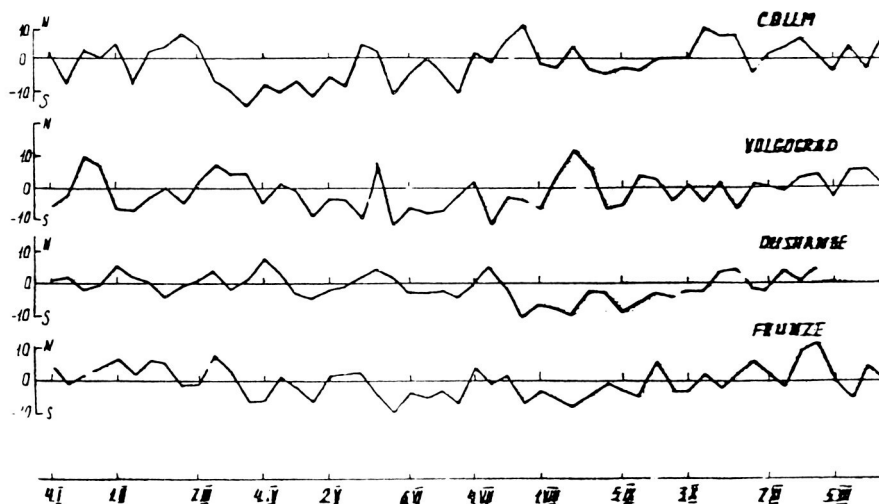


Fig. 2 Meridional winds as for Fig. 1.

normal average development. Tables 1 and 2 show the average values and their dispersions.

On the basis of the observational data, it can be noted that the connection of winter large scale processes in the lower thermosphere with those in the lower strata is different for Europe and Central Asia. This results in differences in intensity, duration and dates of spring reversals. According to the results of European and Central Asian stations, the synchronous reversal of zonal wind is connected with simultaneous activity of two centers in the stratosphere, in our case over the Pacific and North Africa.

Quasi-periodical variations were present in the meridional winds, but correlation between data of any pair of the stations considered is absent. The correlation of the zonal wind characteristics in the summer is also absent. Fig. 3 presents the dependence of the correlation coefficient of the zonal wind on distance during the winter. Fig. 3 shows that significant correlation in zonal wind occurs for distances of up to 2,000 km between stations. This confirms the well known observations from Kazan, Obninsk and Kharkov.

Table 1.

Zonal Wind	\bar{V}_{I-XII}	\bar{V}_{I-IV}	$\bar{V}_{VI-VIII}$	\bar{V}_{IV}	σ_{I-XII}^2	σ_{I-IV}^2	$\sigma_{VI-VIII}^2$
Collm	3,4	-0,3	7,6	-13,5	74	121	31
Volgograd	5,7	1,7	11,0	-10,2	69	74	25
Dushanbe	2,1	0	3,7	- 3,0	15	14	14
Frunze	4,4	4,5	7,2	- 1,5	35	50	17

Table 2

Meridional Wind	\bar{V}_{I-XII}	\bar{V}_{I-IV}	$\bar{V}_{VI-VIII}$	σ_{I-XII}^2	σ_{I-IV}^2	$\sigma_{VI-VIII}^2$
Collm	-1,1	-3,2	-1,2	39	47	32
Volgograd	-1,0	-0,8	-2,6	34	33	21
Dushanbe	-0,3	1,0	-3,6	20	16	17
Frunze	-0,3	0,5	-3,5	25	24	14

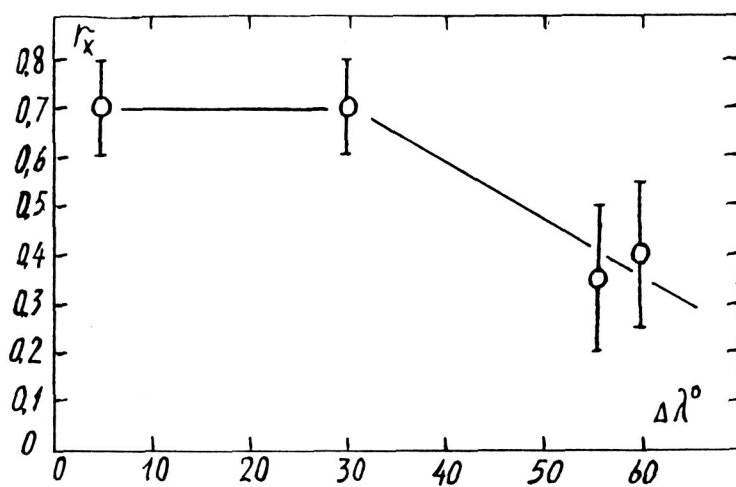


Fig. 3 Dependence of the correlation coefficient of the zonal wind with distance during the winter of 1984. $\Delta\lambda$ is degrees of longitude.